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Natural history and habits
of the codling moth...

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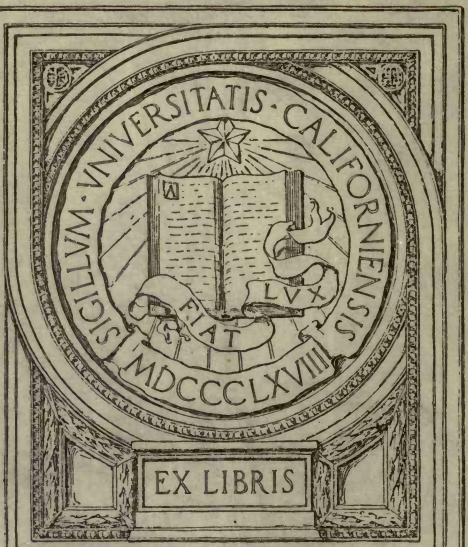

UNIVERSITY FARM

FOR GRATUITOUS DISTRIBUTION.

NATURAL HISTORY

AND

HABITS

OF THE

CODLING MOTH,

(Or APPLE WORM.)

ALSO,

Notes on the Scale Insect.

BY MESSRS. COOKE & SON,

PROPRIETORS

Pioneer Box Factory,

Sacramento, California.

SACRAMENTO:

H. S. CROCKER & CO., PRINTERS AND STATIONERS.

1879.

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PREFACE.

TO THE READERS OF THIS PAMPHLET: We wish it to be distinctly understood that its contents are the result of our own investigation, commenced June, 1877, and continued to the present time. Our object in commencing this investigation was to obtain reliable information of the natural history and habits of the insect pest known as the *Codling* or *Apple Moth;* also to find a remedy that would effectually exterminate the pest. How we have succeeded we leave for our readers to judge.

We respectfully ask of the fruit growers a careful reading, and any information sent us concerning this pest or the scale insect will be thankfully received and preserved for publication.

We are directly interested, in common with the fruit growers, in the extermination of this pest, our business depending especially on their success as producers of choice marketable fruit. It is our purpose to publish, from time to time, such information as we are able to collect, until the natural history and habits of these pests are fully understood, and also such experiments, made by those interested in their destruction, as we know to be reliable. Respectfully,

COOKE & SON,

Pioneer Box Factory, Sacramento, Cal.

SACRAMENTO, Nov. 1st, 1879.

THE CODLING MOTH.

"The Codling Moth is now one of the permanent institutions of the State, and fruit growing, or at least apple and pear growing, have been rendered very unsatisfactory and uncertain."—*Sacramento Record-Union.*

TO THE FRUIT GROWERS OF CALIFORNIA AND ALL WHOM IT MAY CONCERN: It is unnecessary for our purpose to detail the amount of damage done the apple, pear and quince crop of central California since 1874, by the insect pest known as the *Codling* or *Apple Moth*, as unfortunately it is too well known.

In June, 1877, we commenced our investigations to obtain reliable information of the natural history and habits of this pest of the orchard, and respectfully submit the result.

The moth belongs to the family Tortrices, the worm the larva of the *Carpocapsa Pomonella* (the Codling or Apple Moth). The *moth* passes the Winter in the *larva* state, and, in some instances, in the *chrysalis* form. The larva can be found under the loose bark, in the crotches or indents or cracks in the bark of trees affected the previous year. The larva found in apples, pears and quinces are the same species.

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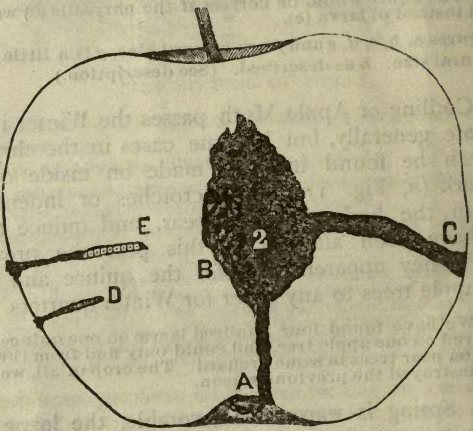
found them on the 20th day of March. We placed them under glass and applied artificial heat. Transformation in one case took place on April 5th, and in all before April 11th.

FIRST APPEARANCE OF THE MOTH.

The moth generally appears from 1st to 20th of May; a few in favorable locations by April 25th. The time at which the eggs arrive at maturity apparently coincides with the end or termination of the pupa or chrysalis state, so that the sexes are ready to unite soon after transformation.

(Fig. 2.)



DESCRIPTION OF FIG. 2.

A. Blossom end of apple, and where larva is supposed to enter the fruit.
B. Represents an empty space where carpellary ovarium or shell containing the seeds were located before the entrance of larva.
C. Represents the burrows made by the larva through the pericarp, by which it escapes from the fruit when it is ready to assume the pupa or chrysalis form.
D. Appearance of larva in burrow when six days old.
E. Appearance of larva in burrow when ten days old.

The moth deposits the egg generally in the blossom end of the fruit (A, Fig. 2), but sometimes on any part (the latter especially late in the season). The eggs are attached to the fruit by a pasty substance. It is our opinion that at the time the egg is deposited the skin of the fruit is punctured, making easy entrance for the larva. It is rare to find more than one egg on any apple, pear, or quince, or more than one larva.

The larva is hatched in from nine to twelve days, and begins to eat eagerly and burrow towards the *carpellary ovarium*, or core containing the seeds (B, Fig. 2).

The larva when hatched can scarcely be seen with the naked eye; at six days, measures nearly one quarter of an inch in length, about as thick as fine silk thread. (1st), first signs of excrement at burrow (D, Fig. 2); at ten days, three eighths of an inch, and about as thick as No. 20 wire (E, Fig. 2). It has burrowed by this time about three fourths of the distance to the seed bag of fruit (B, Fig. 2); at twenty days, nearly full natural size (*c*, Fig. 1), and often as large as *e*, Fig. 1.

When the larva is ready to assume the pupa or chrysalis form, it leaves the fruit by gnawing a hole through the pericarp (D, Fig. 2). Nature has supplied it with a spinneret, the opening apparently in the lower lip, from which issues a viscid fluid in a fine stream, and hardens into silk on contact with the air. By this means it lowers itself to the ground or intervening branches. If it reaches the ground, it immediately crawls toward the tree, and on its journey can often be seen as *e*, Fig. 1. On reaching the tree, it searches for a nesting place under the loose bark in the crotches, or any cavity it can find. If it comes in contact with a branch when leaving fruit, it generally crawls toward the crotches, or until it reaches a hiding place. If under the loose bark it commences building an oval shaped wall, about one sixteenth of an inch high, composed of the viscid fluid from spinneret, and sometimes mixed with pieces gnawed

off the bark; the cover is then put on the nest by using spinneret; the whole completed in twenty-four hours (*a*, Fig. 1). If in a crevice of the bark, the nest is made in different shapes. It is noticeable in the Winter nest the tops and sides are washed with fluid from spinneret, making the nest water-proof to a great extent.

The moth remains in the pupa or chrysalis form from nine to twelve days, in our usual May weather. At the proper time the pupa case is burst open, and the perfect moth appears (*f*, Fig. 1).

It may be asked, How does the moth get out of the nest so neatly made, etc.? By some freak of nature, about twenty-four hours before transformation, the pupa is forced through one end of the nest (*i*, Fig. 1), so that the perfect insect can easily escape.

The chrysalids of this moth are capable of moving lively at any time, from the time they assume the chrysalis or pupa form until the insect escapes perfect.

PROBABLE RATE OF INCREASE OF THESE MOTHS.

Entomologists claim that of the lepidopterous insects, including butterflies and moths, nearly one thousand kinds are known in the United States. That each female lays from 200 to 500 eggs. Taking 200 as the lowest number, twelve female moths in one orchard would produce 2,400 caterpillars; if one half these were females, they would produce 240,000. In proportion, the third generation would reach 24,000,000.

From the observations stated, we are led to believe that the destruction of this pest must be consummated while it is in the caterpillar state.

Is this pest of the orchard only found in California? The damage done by this pest in the States east of the Rocky Mountains is too well known to need repeating. At the present time it is doing so much damage to the fruit crop in parts of Australia that a Commission has

been appointed in Tasmania to investigate and report. (The report, if made, has not reached us.)

For comparison, we give a written statement by Joseph Cronley, Esq., of Lord street, Sandy Bay, as reported to Commission (taken from the "Melbourne Australasian," July 12th, 1879), allowance to be made as to dates for difference of seasons in Australia and California:

"I first observed affected apples in my garden early in January. I took the affected ones off and examined them minutely. At this time there was on some of the affected apples a red spot, with a brown speck in the center, which I supposed to be the egg; at this stage I could not find any grub. Next stage, a small hole covered with excrement, and I found the grub, but very small, about one-eighth of an inch under the surface of the apple. I found some near the core of the apple, and able to crawl about lively when taken out of the apple. If not taken out, the grub will eat its way into the core of the apple, and, in most cases, will eat the pips; then it will bore its way on through the side, or along the core through the eye of the apple. I am told that they weave a web by which they descend from the apple to the ground; I have not seen them doing so, but I have found the web attached to the apple and floating in the air. The apples so pierced by the grub generally fall to the ground; they are sure to do this if the core is eaten away, and very often before the grub leaves the apple. The moth is a night moth. I have seen them in an empty room in which there were apples the previous year, and in which empty cases remained, showing clearly that the grubs will live and come to maturity in any sheltered place. Then the moth does its work of destruction by night. I have seen the egg when recently laid, and have marked it by sticking a gooseberry thorn in the apple near the egg, and watched it until I cut the grub out full grown. I have not seen any recent traces of the moth after about the middle of

March, at which time we had a little cold rain, which rain, I believe, destroyed the grub in the apple by filling the holes with water. Pears and plums are also affected by the grub. I here beg leave to make a few suggestions. I believe the present is a very good time for destroying the grub, as in many gardens they can be found in great numbers under the old bark that is on the trees. I have taken as many as twenty-seven from under the old bark of one tree, and I believe there were many other such trees in the garden. The old bark (every crack and crevice) should be searched for the grubs. As soon as the apples are seen affected on the trees they should be taken off and destroyed. A good large hay band should be tied around the trunk of the tree while the apples are growing, at the height of about one foot from the ground; the grubs will shelter in the bands, which should be taken off every two or three weeks and burned. I believe the grubs will be lessened very much by this means, as they certainly make for the tree for shelter. I believe it would be a good way to burn naked lights on a fine night in the garden—see how many moths are destroyed by rushing into the glare of a candle. I know from visiting many gardens about Hobart Town that some men have lost one-half, and many have lost one-third of their crop of fruit this year by the grub. I know one man who I believe had fully one hundred bushels of apples destroyed by the grub; one-half of these or more he gathered off the trees or the ground and threw them in the street, the remainder he put in a heap in an adjoining paddock. Now, this is not the way to keep the grub under. I asked another man why he did not get those grubby apples off the trees? He said: 'I don't keep them as a source of revenue.' Another man, in answer to a similar question, said: 'I cannot bother with them—if they leave me enough for my use I don't care.' Now these are the kind of men that the industrious fruit-grower seeks protection

against. If the grub gets to the Huon, it is my opinion the Huon people will never rid themselves of it."

Mr. Thomas Johnson also writes to the Commission, giving description of the larva, and concludes:

"With regard to the means of destroying it I can offer no suggestion. My attempt to catch the moths with a lantern, etc., was a failure, although there were hundreds of moths flying about. They have extended their circle very fast this last two years. I do not think eight miles would inclose them about Hobart Town."

What remedies have been tried in California?

In our pamphlet dated January 6th, 1879, we recommended as the most convenient a solution of sulphur and lime to wash the trees with. On application it was not as effectual as we could wish. It would clean the tree; washed off all insect life, excepting the larva we wanted to destroy. It would not kill the larva of the Codling Moth, but would possibly prevent it from assuming the pupa.

D. F. HUTCHINGS. D. M. DUNNE

Phœnix Oil Works,

[ESTABLISHED 1850.]

HUTCHINGS & CO.,

Oil and Commission Merchants.

MANUFACTURERS OF

Codling Moth and Insect Exterminator,

517 Front Street, SAN FRANCISCO.

All Orders Promptly Attended to.

A REMEDY FOUND.

With the assistance of David M. Dunne, Esq., of the firm of Messrs. Hutchings & Co., Phœnix Oil Works, San Francisco, a concentrated wash was produced, consisting of whale oil soap, sulphur, etc., which will destroy the larva or chrysalids of this pest. It has been practically tested on an extensive scale. Result easily described. It kills the larva, improves the tree, and the cost is only nominal.

We will mention here that we are under obligation to Mr. John Cox, of Sutterville, and Mr. T. B. Flint, of Riverside, both places in Sacramento County, and also to Mr. George D. Kellogg, of Newcastle, Placer County, for assisting us in every manner they could in making the experiments, which have proved successful.

We will say frankly to fruit growers, where orchards are affected by this pest, to clean your orchard will

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SOLE AGENT FOR THE

Codling Moth Insect Exterminator

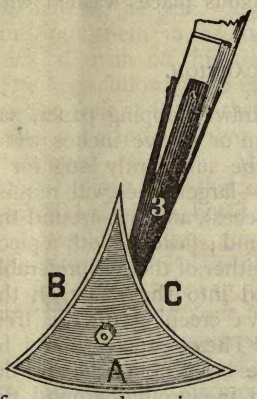
No. 208 K Street, Sacramento, Cal.

take time and labor. It will also take the united action of all fruit growers in each neighborhood. No effort should be spared, as each year the pest will be spreading further and become more numerous. You can rest assured, that from the experiments tried by a few, the returns received were equal to five hundred per cent on the outlay. What better investment could be wished for?

HOW TO PREPARE THE WASH.

Take ten pounds of the concentrated wash and put in a barrel; on this pour two gallons of boiling water, which will form a thick suds; to this add eight gallons of cold water; stir and let stand twelve hours (the longer the better; should be stirred occasionally). The wash is then ready for use. (One pound of codling moth mixture to each gallon of water.)

PREPARING THE TREES.



Immediately after the fall of the leaves, provide some small ship scrapers and grind two of the edges in circles (Fig. No. 3) so that they will be near to the circles of the trees (B and C, Fig. 3). Scrapers length of side four inches, will be large enough. Use handles to suit. Procure a cloth made of old sacks or any material convenient, spread on ground around the tree as far as the scrapings are likely to spread; then commence on the tree as far up as there is any rough loose bark, and scrape it carefully off. Also examine and scrape all crevices in the bark or those formed in the crotches of the tree. Continue scraping until you reach the ground. This

done, *gather the scrapings carefully off the cloth, so that they can be burned or destroyed.*

Be careful that you do not neglect gathering carefully the scrapings and destroying them, as on this point depends a great deal of your success.

Take a common whitewash brush and give the tree a good coat of the whale oil soap and sulphur solution, commencing at the top as far up as there are any cracks or crevices in the bark, and wash down to the ground. Repeat the washing before the Spring; this will destroy any larva or chrysalis left on the tree.

We have been informed by fruit growers that they have found the larva in store rooms, boxes, etc., in the Winter season. During the last two Winters we have made very careful examinations of the fences, shrubbery and packing houses in some orchards, but failed to detect any larva of the Codling Moth. However, careful search should be made and any suspicious places washed with the above solution.

FURTHER PRECAUTION.

Take a piece of common straw wrapping paper, say twenty-four inches long and ten or twelve inches wide, double it lengthwise (this will be sufficiently long for a tree seven inches in diameter—larger trees will require longer bands, in one or more pieces), and put around the tree a few inches above the ground; fasten it with a piece of wire or narrow strip of tin—either of them is preferable to cord, as they can be pressed into the dents on the surface of the tree. The larva creeping up the tree, makes its nest in the paper. These papers should be examined every eighth day, the larva collected and destroyed. Paper or rags laid on the ground around the tree will answer the same purpose, but may not be so easily examined. We would also recommend that some paper or rags should be placed in the crotches of the tree

so as to entrap any larva coming down the branches looking for a nesting place.

We have positive proof that the larvæ will not nest on any part of a tree that has been washed with this solution. Where trees have been washed, they have ascended and nested around the stems of the fruit hanging on tree; therefore the utility of providing traps for them.

The paper bands have been in use for some time by parties in this neighborhood, and are reported as having done good service in the Eastern States.

ANOTHER PLAN FOR DESTROYING THE PEST.

When Mr. Charles W. Reed, proprietor of Washington Orchard, Yolo County, returned from the East last Spring, it was too late in the season to wash his extensive orchard, and only a small portion of it was done. However, he was determined to make an effort to clear his orchard of the pest. He purchased three hundred hogs and put them in his orchard. He employed men to pick all fruit off his trees showing signs of the larva. The hogs followed the men from tree to tree and picked up the fruit as it was thrown down. This operation was often repeated, so that the early broods were nearly destroyed. Result: Mr. Reed shipped twenty-two carloads of fruit East this year against five last year. This plan is expensive, but it is a first-class remedy.

Some other fruit growers having large orchards had the fruit showing signs of larva picked off and destroyed.

Any means taken to destroy the early broods will prevent the late fruit from being destroyed.

The work of exterminating this pest should be the united action of all fruit growers having orchards affected by this pest. It matters not whether the orchards cover large or small tracts of land—*only united action will win the fight.* In proof of this, we will mention one instance. We know of an orchard owned by Mr. A. that

was properly cleaned this last Spring, and the early crop saved from the ravages of this pest. Adjoining was an orchard owned by Mr. B., neglected in every way, early and late crops destroyed. Mr. A. had in his orchard about four hundred boxes of Winter Nellis pears. During the last twenty days of September three fourths of them have been destroyed by this pest. Query: Where did they come from? We will answer, without fear of contradiction, from Mr. B.'s orchard.

To the enterprising and industrious fruit growers of California: Permit us once more to warn you of the danger that threatens the products of your beautiful orchards. Organize a State society; make every effort in your power during the next two months to secure united action in your respective neighborhoods, for the purpose of exterminating the insect pest known as the Codling or Apple Moth. If this fails, apply to the Legislature, which meets next January, and get a bill passed requiring every owner, lessee, renter, or occupant of lands on which there is planted or growing any apple, pear, or quince trees, to uncaterpillar them by picking off and destroying, as prescribed in bill, all fruit affected or showing signs of larva. Also, attaching penalties, etc.

The above may be considered a harsh recommendation, but what we know of the natural history and habits of this pest makes such a recommendation necessary.

We respectfully refer you to a sentence in the letter of Mr. Cronley to the Tasmanian Committee, which we will repeat: "Now, these are the kind of men the industrious fruit grower seeks protection against."

We are sorry to say, but it is nevertheless a fact, that there are many such men in central California as there referred to by Mr. Cronley. Our experiments have brought us in contact with them. They will freely criticise all experiments made by others, but will be remarkably careful they will not try any themselves; and all

the knowledge they claim to possess, their neighbor dare not know it. This class of men should be forced by the strong arm of the law to do their share in work that is a public necessity.

HOW TO EXAMINE THE TREES TO FIND LARVA.

Open the large blade of pocket knife and take off carefully the pieces of loose bark; examine inside part, and if the larva is there, you will find nest, as shown in *a*, Fig. 1. On removing cover off nest, it will either contain larva (*b*, Fig. 1) or chrysalis (*c*, Fig. 1). All crevices and dents in the bark, and crotches, should be examined carefully. Some persons throw the bark away before examining it, thinking the nest is on the tree. This is a mistake.

HOW TO PROCURE SPECIMENS OF THE MOTH.

When you find the larva, if it is not on the loose bark, remove the piece of bark to which it is attached; place it in a small vial, and, if in the Summer time, inside of twelve days you will have a genuine specimen of the moth (*f* and *g*, Fig. 1). Fruit growers can get important information concerning the natural history and habits of the insect pests by experiments in this way.

BRIEF MENTION.

The theory that the moth deposited the egg on the fruit blossom, and that it remained there until the fruit was grown to natural size, is a mistake.

Supposing the moth matured from the Winter larva on the first day of May, the first brood of the season would reach perfection by the 20th of June, and the second brood by the 12th of August. Those matured after the 20th of August deposit the egg that produces the larvæ and chrysalids for the next season.

Fruit growers should examine all boxes returned to their orchards. The pest has been spread over the

country in return boxes from market, where they have been in contact with boxes containing wormy fruit. We have taken six larvæ from one bundle of empty boxes at S. V. R. R. depot, being sent back to the mountain orchards of El Dorado County.

Of pear trees, from twelve to sixteen inches diameter, fair height, one man washed one hundred and fifty per day. One gallon of solution averaged four and one half trees. The Codling Moth Wash is an excellent fertilizer for the tree and produces a smooth bark.

The codling moth wash destroys aphis and all insect life that it reaches, on trees or vines. Grape growers should experiment by washing their young vines twice each year, as we think that it will free them from attacks of insect pests. R. B. Blowers, Esq., of Woodland, Yolo County, indorses this plan for grape vines.

We have received a package of sheep wash from the Standard Soap Company of San Francisco, which we will give a thorough trial and report its effect on the larva of this pest.

It is necessary where an examination is made of an orchard, to examine every tree carefully, of the apple, pear, and quince varieties.

We made an examination of a small orchard containing about seventy-five apple trees, some of them large trees. On fifty-eight that we examined carefully, we found, all told, three larvæ; on the fifty-ninth we found thirty-five in less than fifteen minutes; on the balance we found only a few.

The moth deposits the eggs at night.

Part of the early fruit falls prematurely—when attacked by larva—but little of the late fruit falls before the larva escapes.

NOTE.—Since writing the above, we found in a fruit packing room some larvæ in nests made in a package of paper.

Examine all boxes returned from market before taking into the orchard.

The Codling Moth Wash can be bought in packages weighing from two pounds to two hundred and fifty pounds.

To be successful use every effort to destroy the spring brood of moths.

Fruit showing signs of larva should not be allowed to remain on the ground around the tree.

We have read statements by fruit growers that they have seen the codling moth flying in large numbers. In our investigations we have not seen more than two at any one time.

The moth will live in glass seven (7) days.

The female moths deposit their brood of eggs within forty-eight hours.

The egg can be seen plainly by the naked eye.

The best time to see the moths at work is at dawn of day in the months of June and July.

We do not think the female moths can be decoyed from the trees hy burning lights at night in orchard until all the eggs in the ovary are deposited.

In our experiments we found the female moths to be about forty per cent. of the number hatched.

Only united action of fruit growers will gain a complete victory over this pest.

Defer not your action—the time arrives as soon as the leaves fall.

AN ENTERPRISING FRUIT GROWER.

Mr. James B. Saul, of the Oak Shade Fruit Company, Davisville, Yolo County, read our pamphlet of January 6th, 1879. He called at our office and examined the larvæ, etc., we had collected. He had not observed any signs of this pest in his orchard. However, he set his men to work and examined every tree carefully, and to his surprise, two larvæ were found in

one of his apple trees. Without wasting any time, war was declared against the pest. Washing done, early in the season paper bands were placed on the trees, and throughout the season examined every six days. He also prevailed upon his neighbors to take the same measures to fight the pest. Mr. Saul evidently believes the old proverb, "An ounce of prevention is better than a pound of cure."

Moral: "Go ye and do likewise."

SCALE INSECTS,

ON ORANGE, APPLE AND PEAR TREES.

During a recent visit to Southern California our attention was called to a pest found in some of the orange orchards, known as the *Red Scale.* It is not only found on the branches and foliage of the tree, but also spreads over the fruit. We have not had time to make such inquiry or experiments as we would wish to, but it has been our good fortune, since our return, to meet a gentleman from Louisiana who is thoroughly acquainted with the culture of orange trees during the past fifty years, and also with the troubles growers have to encounter—such as scale insects, etc., etc. He attributes the cause of such pests, to a great extent, to want of care and proper attention; growers taking crop after crop for a succession of years, neglecting to make an effort to strengthen and nourish the tree—only what can be obtained from mother earth, and the pruning knife.

We will repeat a comparison made by him: "Take the human being, for instance. Exact from him more than ordinary labor, deprive him of proper food, etc., etc., and he will become filthy. So with the fruit."

He states that a trench dug around the tree and filled with strong manure, then covered with the earth taken out, or give the body of the tree a good washing with strong soft soap lie or the refuse known to soap makers as "Nigger." In addition, wash the branches and foliage with some alkali wash to complete the work. If either of the above preparations are properly applied, all insect life will be destroyed.

R. Williamson, Esq., of the firm of W. R. Strong & Co., sent us from a neighboring County some specimens of apples, and also pieces of branches of the tree they were taken from, which were covered by a scale somewhat similar in appearance to the so-called Red Scale found on the orange trees, though not quite so large. We visited the orchards where they were taken from, also other orchards in the neighborhood, and found this scale also on the pear trees and fruit. In many cases limbs and branches are completely covered, and in some cases the parts of the trees affected are only dead timber. This scale is also found on the fruit of trees affected.

We have tried some experiments on the specimens now in our possession, both of the orange and apple trees, and we believe that if the trees are thoroughly saturated with the wash used for the Codling moth, that it will not only destroy the scales on the tree and foliage, but will protect the tree from further attacks.

Note.—The wash for trunk of the tree should be made and put on as thick as possible.

Mr. Titus, of San Gabriel, Los Angelos County, very kindly gave us a description of an apparatus he constructed for washing trees. He placed on the bed and running gear of a wagon a large wine cask—capacity about one hundred gallons—to which he attached an ordinary force pump. The fluid wash is put in the cask and forced by pump through a hose with perforated nozzle. With this apparatus from seventy-five to one hundred large orange trees can be thoroughly washed per day.

For apple and pear trees, when stripped of foliage, the ordinary garden pump will be sufficient.

To Nurserymen: In a flower garden in this city we found a rosebush that was nearly covered with a species of this scale insect. We applied the sulphur and lime solution in July, but it had little effect. On the 15th of September the stem and branches were covered so thick that they appeared as if whitewashed. We applied the Codling Moth Wash and in a few days the scale was destroyed. We have called the attention of several persons, and had them examine the residue left on the stem and branches. Among those who examined was I. N. Hoag, Esq., Secretary State Agricultural Society. All agree that the destruction of the insect was complete.

At the Los Angeles Horticultural Fair (1879), we met Albert S. White, Esq., of Riverside, San Bernardino County, and requested him to try some experiments by applying the Codling Moth Wash on the scale found on orange trees. We forwarded to him a package of the preparation, and have received the following report:

RIVERSIDE, Nov. 3d, 1879.

Messrs. COOKE & SON—

Gentlemen: I have given the preparation sent me a thorough trial, and find that it makes very short work of the scale bug. Yours, truly,

ALBERT S. WHITE.

We are under obligations to C. H. Dwinelle, Esq., of the State University, Berkeley, for the following communication in answer to our inquiries concerning the scale insect:

MR. MATTHEW COOKE—

Dear Sir: The specimens which you sent me of the scale insect from the rose, and your inquiries in regard

to the similar pests found in our apple, pear and orange orchards, have interested me very much.

You have opened a subject, the importance of which, to the fruit growers of California, can hardly be overestimated. The rose scale has been known in the counties about San Francisco Bay for many years past, as one of the worst parasites of the rose bush.

THE SCALE INSECTS OR BARK LICE

Belong to the order of the *Hemiptera*, which includes the true "bugs." The Chinch bug, Squash bug and their allies, are good examples of the order, and are notorious for their evil doings. The Phylloxera is also a worthy representative. The family of the *Coccidae* includes the scale insects proper. Over thirty species have been found in Great Britain, and it is not likely that California will have to yield anything in point of numbers. A glass of considerable power is needed to study them to advantage.

THE APPLE SCALE.

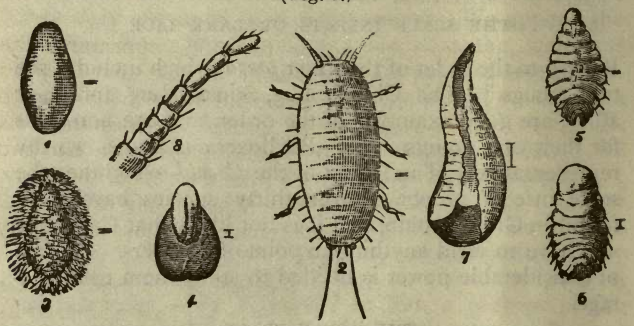
(Fig. 1.)

The most common apple scale insect is generally known to naturalists as the oyster-shell bark-louse (*Aspidiotus conchiformis*), named from the form of the scale. Packard says that it does more harm to the apple tree than any other insect known. Prof. Riley also notes its occurrence on the pear, plum and currant. I believe that the first I saw of it in this State was about the Spring of 1865, in Oakland, but it may have been an old settler then. The first cut here given (Fig. 1) shows this scale of natural size, as it appears on the apple bark.*

* For the use of these cuts we are indebted to the proprietors of the *Pacific Rural Press.*

The scales of the present season are of a dark brown color and smooth surface, as if waxed or varnished, and fastened securely to the bark to keep out the elements. At the small end of the scale is what appears like an oval plate, of a light amber color, which is said to be the cast off skin of the insect in the larva state.

(Fig. 2.)



On loosening one of these fresh scales, it will be found nearly full of pure white eggs (Fig. 2.) (1, greatly magnified), closely packed, and waiting for the warm weather to hatch them out next Spring. There may be anywhere from ten to one hundred eggs under each scale. Fortunately some of the small birds, as the wrens and chickadees, devour immense numbers of these eggs before they hatch. It is said there is a mite, similar to those found in cheese and raw sugar, which sucks the eggs of this *Aspidiotus*. I saw such an one in a colony of apple scales yesterday, but did not catch him in the act of egg-sucking. The mites may be distinguished from the young of the scale by having eight legs, instead of six. You may have to put a drop of alcohol, benzine, or the like, on one to keep him quiet enough to make out the number of his legs.

The time when the eggs of the scale hatch depends much on temperature, and varies with locality. On the Atlantic coast it is the last of May and first of June. I cannot give the date for this State, although I have often noticed the young insects. Each fruit grower should keep watch of the insects on his premises, and note the date of their transformations, for on this knowledge the success or failure of his efforts to exterminate them will largely depend.

One authority says that on their first appearance the young (Fig. 2) (2) are nearly white, another that they are redish. Those that I have noticed were so dark as to appear to the naked eye like a rust. Besides their six legs, they have two antennae, and the female has two stylets or hair-like appendages from the rear of the body. Fig. 2 (8) is one of the antennae highly magnified. Although at first active, the female becomes stationary at the end of about ten days.

"A white waxy secretion issues from the body in the shape of fine threads." (Fig. 2) (3.) This secretion increases and hardens into a yellowish brown, oval, scale, which hides the body of the insect. An addition is soon made which is wider than the original scale, and darker in color, as in Fig. 2 (4). The scale continues to enlarge until it assumes the form seen in (7), and is about 12-100ths of an inch in length, while its occupant is only about one-half as long. This development occupies about two months from the time of hatching. Meantime the female has lost her limbs and other appendages, so as to assume the form shown in (5) and finally as in (6).

Ten or twelve days after her scale has reached its full size, the female begins to lay her eggs, and completes the process in about two weeks. She decreases in size, until at last, when she dies and dries up, it is hard to find any trace of her. In the Mississippi valley, there is but one generation in a season, but I know of no one who has

watched the pest close enough to say whether such is the case here or not.

HOW THE "SCALE" IS INJURIOUS.

The *Coccidae* injure the trees by piercing the bark and sucking the sap. Although so very small—the one in question being five one-hundredths of an inch in length—their numbers often enable them to destroy large trees. Fruit also is greatly diminished in value when infested by them. The male insect does not lose his legs while under the scale, but his beak or sucking apparatus disappears. He finally emerges with a pair of gauzy wings, and so different in appearance from the female as frequently to be taken for an insect of an entirely distinct order.

ANOTHER APPLE SCALE

Which is also found on the pear, is known as *Aspidiotus Harisii*, has the scale oval, nearly flat, and of a milk white color, while the eggs are red. I do not know that it has been reported as yet in this State.

WHEN TO DESTROY.

The greatest execution can undoubtedly be done when the insects are just out of the egg, and not yet covered with their scales. There are many washes which will destroy them at that time, if but a drop touches them. As a rule, alkaline washes of moderate strength are good; for example, two pounds of potash in seven quarts of water; diluted lie made from wood ashes; lime water, etc. Some years ago Prof. Hilgard advised a nurseryman in this vicinity to use coal tar water, that is, water that had stood for some time in a barrel with coal tar at the bottom of it, the tar being stirred up occasionally. This year the San Jose papers report good results from using this remedy. Any of these may be applied by means of a garden syringe or engine so as to wet every

part of the tree. The young insects usually appear soon after the tree blossoms.

AT THIS TIME OF THE YEAR

The scales should be loosened by using a stiff brush, and at the same time applying the wash, which should be calculated to dissolve the wax. Strong soap-suds have long been commended for this purpose. In Western New York, I found a solution, in which whale oil soap and tobacco juice were the chief ingredients, to be a sovereign remedy for all insects that could be reached by it. The scraping and washing advised by you for the Codling Moth ought to exterminate the scale as far as it goes.

BE THOROUGH.

The scale should be destroyed in some way, for the tree infested by it can not thrive. The trunk and limbs, as far as accessible, should be thoroughly cleaned. All trimmings should be burned as soon as possible. If the trees are yet young it might pay to cut them back so that every part could be reached, even if the fruit be lost for a season. Repeat the application after a few days, to destroy late hatched insects or those overlooked the first time.

THE ORANGE AND LEMON SCALES

Belong to several genera, *Aspidiotus*, *Lecanium*, etc. Their development is, in a general way, similar to that of the apple scale. Their presence must be recognized, and they must be fought, if our orange growers hope for the highest success. The remedies already given above are good, if faithfully applied at the right time. I have neither time or space to pursue this subject further at this time.

If by your efforts you can rouse our fruit growers to the study of the insect enemies that are causing them so

much loss, and persuade them to take active measures to subdue them, you will "deserve well of your country."

Wishing you all success in your efforts, I remain,

Yours truly,

C. H. DWINELLE.

UNIVERSITY OF CALIFORNIA,
BERKELEY, Nov. 15th, 1879.

Any person interested can have a package of the Codling Moth Wash, free of cost, to experiment on the scale insect or Codling Moth, by applying to Messrs. Hutchings & Co., 517 Front street, San Francisco, by letter or otherwise. All persons having any wash or remedy for this pest, by sending us a package, we will have it thoroughly tested and report results. *We have nothing of the kind to sell; only wish to find the best.*

COOKE & SON,
Proprietors Pioneer Box Factory,
SACRAMENTO.

SACRAMENTO, Nov. 20, 1879.

NOTE.—We have avoided, as much as possible, mentioning names and localities—also results of experiments—but have in our possession abundant proof of the merits of the remedies recommended. Any information in our possession will be freely given to any person applying by letter or otherwise. C. & S.

TOWLE BROS. & CO.,

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DUTCH FLAT, PLACER COUNTY,

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Sugar Pine, Yellow Pine, Spruce and Fir

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Of Every Description.

HEAVY MINING TIMBER A SPECIALTY.

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JOIST, SCANTLING, FLOORING, RUSTIC, CEILING,

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Orders for any quantity and every character of MOUNTAIN LUMBER promptly filled.

An experience of twenty years has given the firm a thorough knowledge of the business, and the wants of consumers.

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RETAIL YARDS.

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NOTICE!

All persons take notice that we—

COOKE & SON,

Proprietors of the

Pioneer Box Factory,

SACRAMENTO CITY, CAL.,

Warn all persons from using or making any

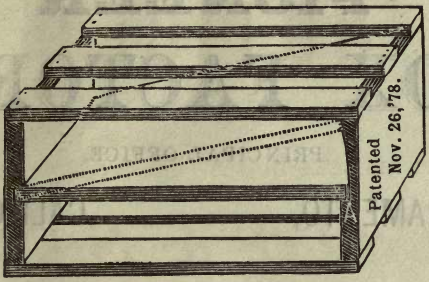
FRUIT BOXES OR CRATES

That in any way infringe on our patent issued Nov. 26th, 1878, No. 210,241, as we will prosecute any person that makes or uses the same. [See next page.]

MATTHEW COOKE.
ROBERT J. COOKE.

SACRAMENTO, Aug. 1st, 1879.

CHALLENGE FRUIT CRATE.



COOKE & SON, Patentees.

A. Slanted wall and shoulder where false bottom rests in combination with slot in opposite end. Dotted line represents false bottom being put in place.

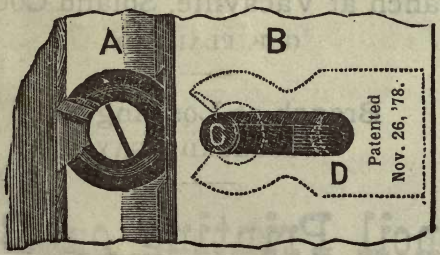
PIONEER BOX FACTORY,

Corner of Front and M streets, Sacramento.

COOKE & SON, - - - - - - - - Proprietors.

All kinds of Fruit and Packing Boxes made to order or in Shooks.

CHALLENGE BOX FASTENER.



COOKE & SON, Patentees.

A. Represents cover fastened on box. B. Cleet on cover with slot C and pip on fastening. D. Dotted line represents fastening when not in use.

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